

# PATENT ABSTRACTS OF JAPAN

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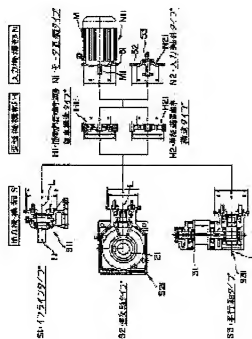
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## (54) REDUCTION GEAR SERIES

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a plurality of product groups of the minimum kinds of parts by connecting in order an output, a change gear, and an input mechanism selected one each out of each output, change gear, and input mechanism selection groups containing a plurality types of mechanisms.

**SOLUTION:** This series is constituted of respective selection groups of an output mechanism part S, a change gear mechanism part H, and an input mechanism part N. The output mechanism part S selection group is provided with an in-line type A1, a rectangular shaft type S2, and a parallel shaft type S3, the change gear mechanism part H selection group is provided with a one gear type swing internal-contact engagement planetary gear structure type H1 and a one gear type simple planetary gear structure type H2, and the input mechanism part N selection group is provided with a motor direct-contact type N1 and an input shaft addition type N2. Arbitrary ones selected from the output mechanism part S11, 21, 31 plus the change gear mechanism part H11, 21, and the change gear mechanism part H11, 21 plus the input mechanism part N11, 21 can be assembled together. The selected mechanism parts S, H, N are connected in this order so that a plurality of change gear ratio can be obtained under the same conditions of the tie-in dimension of the mating machine.



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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to suitable reduction-gears series to prepare two or more various GIYADO motors as a product group based on rational thought technically.

[0002]

[Description of the Prior Art]The series of the GIYADO motor is indicated by JP,8-4844,A. This series comprises two or more GIYADO motors which combine various motors and a gearbox.

Under the conditions of being the same (if it says by the below-mentioned embodiment, it will be the same frame number), the \*\*\*\* size to a mate machine makes selectable two or more change gear ratios.

And prepare the range of at least  $1/3 - 1/100$  as a change gear ratio, and on the GIYADO motor which constitutes the undermoderation ratio side. The simple epicyclic gear structure of one-step type was adopted as speed change structure of said gearbox, and, on the other hand, the rocking inscribed engagement type epicyclic gear structure of one-step type is adopted as the GIYADO motor which constitutes the high reduction ratio side as speed change structure of said gearbox.

[0003]

[Problem(s) to be Solved by the Invention]By the way, the series of the above-mentioned conventional GIYADO motor, he trying to combine with various motors only within in-line type (type which has an output shaft on an input-shaft line) reduction gears, therefore, When there is a request of liking to use an orthogonal-axis type and parallel-axis type reduction gears, from the restrictions on attachment with a mate machine, etc., Or when there was a request of liking to use the reduction gears which used the hollow shaft for the output shaft, another series completely had to be prepared and there was a problem that a total component type will increase.

[0004]An object of this invention is to provide the reduction-gears series which can prepare many product groups in order to meet many requests, suppressing a component type in consideration of the above-mentioned situation to the minimum.

[0005]

[Means for Solving the Problem]An output-device part choice group in which reduction-gears series of an invention of claim 1 contains an output-device part of two or more types, It has a speed change

mechanism part choice group containing a speed change mechanism part of two or more types, and an input-device part choice group containing an input-device part of two or more types, By connecting with this order an output-device part, a speed change mechanism part, and an input-device part which were chosen from these choice groups every one piece each, Under conditions of being the same, a \*\*\*\* size to a mate machine is one set of a reduction gear which made selectable two or more change gear ratios the reduction-gears series to constitute, and an output-device part and a speed change mechanism part of each type, A \*\*\*\* size is unified so that the arbitrarily selected things can be connected mutually, and a speed change mechanism part and an input-device part of each type, A \*\*\*\* size is unified so that the arbitrarily selected things can be connected mutually, and in said output-device part choice group, An in-line type which has an output shaft on an input-shaft line at least, and an orthogonal-axis type which has the output shaft which intersected perpendicularly with an input-shaft line, At least, a parallel-axis type output-device part which has an output shaft parallel to an input-shaft line is contained, it is contained by speed change mechanism part of one-step type a rocking inner gearing planetary gear structure type of one-step type, and simple epicyclic gear structure type in said speed change mechanism part choice group, and in said input-device part choice group, at least, an input-device part of a motor direct connection type and a type with an input shaft is contained -- it is alike rattlingly and an aforementioned problem is solved more.

[0006]Namely, by preparing next type [ like ] of thing for each choice group of an output-device part, a speed change mechanism part, and an input-device part, respectively, and choosing and combining one arbitrary thing with it at a time out of each choice group in this series, as shown in drawing 1, One set of a reduction gear can be constituted now.

[0007](a) the output-device part S1:in-line type S2:orthogonal-axis type S -- a 3:parallel-axis type (b) speed change mechanism part H1:rocking inner gearing planetary gear structure type H2:simple epicyclic gear structure type -- a type with a (c) input-device part N1:motor direct connection type N2:input shaft [0008]In reduction-gears series of an invention of claim 2, by including a rocking inner gearing planetary gear structure type speed change mechanism part of one-step type, and a simple epicyclic gear structure type speed change mechanism part of one-step type in said speed change mechanism part choice group, In this speed change mechanism part, a change gear ratio of  $1/3 - 1/100$  within the limits was prepared selectable.

[0009]By the way, when enabling connection of each mechanism part of an output-device part, a speed change mechanism part, and an input-device part selectively, how connection is realized concretely poses a problem. Especially in the case of this invention, have composition that combination of epicyclic gear structure type a speed change mechanism part and an output-device part is enabled arbitrarily, but. A point how for a problem that parts will make this double in near a plane of composition if both are completed independently simply, respectively to occur, and to transmit power of a speed change mechanism part to the output-device part side also becomes a concrete problem.

[0010]In reduction-gears series of the invention according to claim 3. The number of pins which penetrate an epicyclic gear of an epicyclic gear structure type speed change mechanism part for this point, This was solved by making completely the same an outer diameter and a position from the center at each speed change mechanism part, carrying out formed protruding of this pin from the said

each type of output-device part side in the state of a support at one end, and having composition which inserts an epicyclic gear of a speed change mechanism part in this pin at the time of an assembly.

[0011]By this a speed change mechanism part of each type at a pin by which support-at-one-end formation was carried out from the output-device part side by a common formation mode. It will be assembled in a form where the whole speed change mechanism part containing an epicyclic gear is inserted in, Problems, such as weight increase by double-izing of parts and enlargement, can be prevented now also from enabling direct transfer of power from the speed change mechanism part side to the output-device part side, securing the compatibility of attachment of each type, and also occurring.

[0012]

[Embodiment of the Invention]Hereafter, the embodiment of this invention is described based on a drawing.

[0013]Drawing 1 is a lineblock diagram showing the overview of the reduction-gears series of an embodiment. This reduction-gears series consists of the choice group of the output-device part S, a choice group of the speed change mechanism part H, and a choice group of the input-device part N. In this series, according to capacity or torque (specifically size), several kinds of "frame numbers" is set up so that it may double with a mate machine, and this invention can be applied now for every frame number, respectively. Namely, by connecting with this order the output-device part S, the speed change mechanism part H, and the input-device part N which were chosen from the choice group of each frame number every one piece each, One set of the reduction gear which made selectable two or more change gear ratios can consist of now under the conditions that the \*\*\*\* size to a mate machine is the same (a frame number is the same). Therefore, the user can choose from series the reduction gear which has the torque (capacity) according to the purpose, a size, or revolving speed.

[0014]The in-line type S1 output-device part S11 which has the output shaft 11 on the input-shaft line L in the choice group of the output-device part S, The orthogonal-axis type S2 output-device part S21 which has the output shaft 21 which intersected perpendicularly with the input-shaft line L, and the parallel-axis type S3 output-device part S31 which has the output shaft 31 parallel to the input-shaft line L are formed.

[0015]The bevel gear or helical gear which constitutes the last deceleration mechanism is provided in the orthogonal-axis type S2 output-device part S21 and the parallel-axis type S3 output-device part S31, and the gear which constitutes the last deceleration mechanism is being fixed to the moderating ratio common to both types. It is because this narrowed down the purpose of the output-device part to providing the variation of the connection of a mate machine as much as possible, The kind of output-device part is reduced by this, and the problem that an overall gear ratio will change can be prevented so much from occurring by having changed the type of the output-device part.

[0016]In the choice group of a speed change mechanism part, the rocking inner gearing planetary gear structure type H1 speed change mechanism part H11 of one-step type and the simple epicyclic gear structure type H2 speed change mechanism part H21 of one-step type are formed.

[0017]Here, as the rocking inner gearing planetary gear structure type speed change mechanism part

H11, the change gear ratio is prepared only 1/6 or more things. In this type of speed change mechanism part H11, when this is technically difficult to set a moderating ratio to less than 1/6 and it adopts a rocking inner gearing planetary gear structure type, it is because a low speed and a high reduction ratio (high torque) are meant from the first in many cases.

[0018]Then, the part, i.e., the moderating ratio to  $1/3 - 1/6$ , is covered with the simple epicyclic gear structure type speed change mechanism part H21. The moderating ratio of  $1/3 - 1/100$  can be made by one step of speed change mechanism part H, and it has come to be able to perform selection of the moderating ratio of the wide range thereby.

[0019]In the choice group of the input-device part N, the motor direct connection type N1 input-device part N11 and the input-device part N21 of Type N2 with an input shaft are formed. The motor direct connection type N1 input-device part N11, The flange 51 for linking with the motor M directly with the speed change mechanism part H1 and H2 is attached, and it becomes the speed change mechanism part H11 and the input shaft of H21 itself by the output shaft M1 of the motor M being fitted over the speed change mechanism part H11 and the feed hole of H21.

[0020]Even if it has the same horsepower, as the motor M in this case A general mere induction motor, Various motors including the control circuit which \*\* the motor etc. which were formed into full water proof, and is attached are prepared for a motor with a brake, the motor whose revolving speed control is possible with the constant torque which has an inverter control circuit, and the improvement in safety.

[0021]On the other hand, the input-device part N21 of Type N2 with an input shaft is provided with the following.

The speed change mechanism part H11, the flange 52 combined with H21.

The input shaft 53 which penetrates this flange 52 enabling free rotation.

This input shaft 53 is inserted in the speed change mechanism part H11 and the feed hole of H21, and turns into this speed change mechanism part H11 and an input shaft of H21.

[0022]And mutual inlaw part (fitting part for alignment) dimension a and mounting bolt pitch-diameter B can be unified, and the arbitrary selected things can be combined now about each output-device part S11, S21, S31, and the speed change mechanism part H11 and H21. The mutual inlaw part size C and mounting bolt pitch-diameter B can be unified also about each speed change mechanism part H11, H21 and the input-device part N11, and N21, and the arbitrary selected things can be combined now.

[0023]Each is alone convenient and they have come to carry out unitization of all of these each output-device part S11, S21, S31, the speed change mechanism part H11, H21, the input-device part N11, and N21, and to be able to perform stock, conveyance, etc. Unitization especially of the principal part of each output-device part S11, S21, and S31 and the motor direct connection type input-device part N11 is carried out by the (after-mentioned) by the sealed state.

[0024]Next, the details of each mechanism part are explained, referring to three (the type of the output-device part S and the type of the speed change mechanism part H were changed, respectively) sorts of GIYADO motors illustrated to drawing 2 - drawing 6.

[0025]Drawing 2 shows the constructional example of the GIYADO motor constituted combining the in-line type S1 output-device part S11, the rocking inner gearing planetary gear structure type H1

speed change mechanism part H11, and the motor direct connection type N1 input-device part N11. Drawing 3 is an III -III arrowed cross-section figure of drawing 2.

[0026]Drawing 4 shows the constructional example of the GIYADO motor constituted combining the orthogonal-axis type S2 output-device part S21, the simple epicyclic gear structure type H2 speed change mechanism part H21, and the motor direct connection type N1 input-device part N11.

Drawing 5 is a V -V arrowed cross-section figure of drawing 4.

[0027]Drawing 6 shows the constructional example of the GIYADO motor constituted combining the parallel-axis type S3 output-device part S31, the simple epicyclic gear structure type H2 speed change mechanism part H21, and the motor direct connection type N1 input-device part N11.

[0028]First, the details of the structure of each output-device part S11, S21, and S31 are explained.

[0029]The output-device part S11 of the in-line type S1 shown in drawing 2 has the output shaft 11 on the input-shaft line L. The output shaft 11 has penetrated the casing 12 to which the mount 12a was attached, and is supported by the two bearings 13a and 13b which set and allotted the interval to this casing 12, enabling free rotation.

[0030]The flange 15 as a power input side is really formed in the end face side of the output shaft 11, and two or more pins 100 are being fixed by this flange 15 at constant pitch on the circumference centering on the input-shaft line L (it is formed protruding in a support-at-one-end state). When the combination partner of these pins 100 is the rocking inner gearing planetary gear structure type H1 speed change mechanism part H11, The inner pin of rocking inner gearing planetary gear structure is constituted from combining, and when a combination partner is the simple epicyclic gear structure type H2 speed change mechanism part H21, the hold pins of simple epicyclic gear structure consist of combining.

[0031]It is provided in the end of the casing 12 by the flange 19 for connection to the speed change mechanism part (the example of drawing 2 speed change mechanism part H11) which is a combination partner, and at it to this flange 19. The through hole 19b (pitch-diameter B) of the inlaw part (the example of drawing 2 inlaw part 67a) by the side of a speed change mechanism part, the inlaw part 19a (dimension a) which fits in each other, and the mounting bolt 101 for connection is formed.

[0032]Next, the output-device part S21 of the orthogonal-axis type shown in drawing 4 has the output shaft 21 arranged so that it may intersect perpendicularly with the input-shaft line L. In this case, the output shaft 21 consists of hollow shafts (hollow shaft). In this output-device part S21, arrange the input shaft 23 by the bearings 24a and 24b to the one side part of the gearbox 22, enabling free rotation, and. The gearbox 22 is penetrated, and the output shaft 21 is arranged, enabling free rotation so that it may intersect perpendicularly with the input shaft 23, and it has composition which engaged the bevel pinion 26 provided in the input shaft 23, and the bevel gear 27 provided in the output shaft 21.

[0033]The flange 25 as a power input side is formed in the end face side of the input shaft 23, and two or more pins 100 are being fixed by this flange 25 at constant pitch on the circumference centering on the input-shaft line L. These pins 100 carry out the completely same duty as the case of the output-device part S11 of the in-line type mentioned above, and are made respectively the same [ the number, an outer diameter, and the position from the center ].

[0034]It is provided in the end of the gearbox 22 by the flange 29 for connection to the speed change mechanism part (the example of drawing 4 speed change mechanism part H21) which is a combination partner, and at it to this flange 29. The through hole 29b (pitch-diameter B) of the inlaw part (the example of drawing 4 inlaw part 77a) by the side of a speed change mechanism part, the inlaw part 29a (dimension a) which fits in each other, and the mounting bolt 101 for connection is formed.

[0035]Next, the output-device part S31 of the parallel-axis type shown in drawing 6 has the output shaft 31 arranged in parallel with the input-shaft line L. In this case, the output shaft 31 consists of hollow shafts (hollow shaft). In this output-device part S31, the input shaft 33 is supported by the bearings 34a and 34b on the input-shaft line L set as the gearbox 32, enabling free rotation, and the output shaft 31 is supported by it and parallel by the bearings 37a and 37b, enabling free rotation. And the helical gear 38 provided in the output shaft 31 has geared with the helical gear 36 provided in the input shaft 33.

[0036]The flange 35 as a power input side is formed in the end side of the input shaft 33, and two or more pins 100 are being fixed by this flange 35 at constant pitch on the circumference centering on the input-shaft line L. These pins 100 also carry out the completely same duty as the case of the in-line type output-device part S11, and are made respectively the same [ the number, an outer diameter, and the position from the center ].

[0037]It is provided in the end part of the gearbox 32 by the flange 39 for connection to the speed change mechanism part (the example of drawing 6 speed change mechanism part H21) which is a combination partner, and to this flange 39. The through hole 39b (pitch-diameter B) of the inlaw part (the example of drawing 6 inlaw part 77a) by the side of a speed change mechanism part, the inlaw part 39a (dimension a) which fits in each other, and the mounting bolt 101 for connection is formed.

[0038]Next, each speed change mechanism part H11 and the details of H21 are explained.

[0039]First, the rocking inner gearing planetary gear structure shown in the example of drawing 2 and the GIYADO motor of drawing 3 is explained.

[0040]The eccentric body by which rocking inner gearing planetary gear structure was generally provided in the 1st axis and this 1st axis, The external gear attached to the 1st axis in the state in which eccentric rotation is possible via this eccentric body, This external gear is the thing provided with the internal gear which carries out inscribed engagement, and the 2nd axis connected with said external gear via a means to transmit only the rotational components of this external gear, and it is well known as a structure which a moderating ratio can realize with an one-step type to about [ of 1/6 or more ] 1/119.

[0041]In the example of drawing 2 and drawing 3, use said 1st axis as an input shaft (motor output shaft M1), and use the 2nd axis as an output shaft, and. The above-mentioned structure is made the slowdown, and where the output-device part S11, the speed change mechanism part H11, and the input-device part N11 are combined, rocking inner gearing planetary gear structure will not be constituted without fixing an internal gear.

[0042]Key connection of the eccentric body 61 is carried out to the motor output shaft M1 as an input shaft, and the external gear 63 is attached to the eccentric body 61 via the bearing 62. The pin 100 (function as [ In this case ] an inner pin) and the internal roller 66 which two or more roller holes 64

were formed in this external gear 63, and were formed there at the output-device part S11 side have fitted in loosely. External teeth, such as a trochoid tooth profile and a circle tooth profile, are provided in the periphery of the external gear 63, and inscribed engagement of the external tooth is carried out with the internal gear 67 which serves as a casing. The internal tooth of the internal gear 67 consists of the outside pin 68 which fitted loosely into the pin hole.

[0043]The inlaw part 67a (dimension a) for the alignment with the output-device part S11 (output-device part another type is also good) side is formed in the end face of said internal gear 67 which serves as a casing. And the GIYADO motor shown in drawing 2 is constituted by uniting and binding tight the output-device part S11, the speed change mechanism part H11, and the motor direct connection type input-device part N11 with the mounting bolt 101.

[0044]Thus, in the GIYADO motor which contains the constituted rocking inner gearing planetary gear structure, if the motor output shaft M1 which is an input shaft rotates one time, the eccentric body 61 will rotate one time. Although the external gear 63 also tries to perform rocking rotation around the input shaft 1 by one rotation of this eccentric body 61, since that rotation is restrained by the internal gear 67, the external gear 63 will only rock almost, being inscribed in this internal gear 67.

[0045]When the number of teeth of N and the internal gear 67 is set to  $N+1$  for the number of teeth of the now 63, for example, external gear, the difference of gear teeth number is 1. Therefore, the external gear 63 becomes what is shifted by one gear tooth to the fixed internal gear 67 (it rotates) for every rotation of the motor output shaft M1. This means what one rotation of the motor output shaft M1 was slowed down for by the rotation (minus shows counterrotation) which is  $-1/[$  of the external gear 63 ] N.

[0046]That rocking ingredient is absorbed by the crevice between the internal roller hole 64 and the pin 100 (internal roller 66), and, as for rotation of this external gear 63, only rotational components are transmitted to the output shaft 11 via the pin 100 by it. As a result, the slowdown of moderating ratio- $1/N$  is attained.

[0047]Next, the simple epicyclic gear structure shown in the example of drawing 4 and the GIYADO motor of drawing 5 is explained.

[0048]The sun gear 71 with which this simple epicyclic gear structure was combined with the motor output shaft M1 as an input shaft, it consists of the three epicyclic gears 72 which carry out circumscription engagement with this sun gear 71, the internal gear 77 which served as the casing in which this epicyclic gear 71 carries out inscribed engagement, and the pin 100 (function as [ In this case ] hold pins) which holds the epicyclic gear 72 via the needle bearing 73 enabling free rotation. Here, the sun gear 71, the epicyclic gear 72, and the internal gear 77 are constituted from a helical gear by each for the noise reduction.

[0049]The inlaw part 77a (dimension a) for the alignment with the output-device part S21 (output-device part another type is also good) side is formed in the end face of said internal gear 77 which serves as a casing. And the GIYADO motor shown in drawing 4 is constituted by uniting and binding tight the output-device part S21, the speed change mechanism part H21, and the motor direct connection type input-device part N11 with the mounting bolt 101.

[0050]Thus, in the GIYADO motor which contains the constituted simple epicyclic gear structure, if the motor output shaft M1 which is an input shaft rotates one time, the sun gear 71 will rotate. If the



sun gear 71 rotates, while the epicyclic gear 72 is inscribed in the internal gear 77, the periphery of the sun gear 71 will be revolved around the sun. The epicyclic gear 72 is supported by the pin 100 and the revolution to the sun gear 71 of this pin 100 is transmitted to the input shaft 23 of the output-device part S21 from the flange 25. And the deceleration rotation transmitted to the input shaft 23 is changed into rectangular directions via the bevel gear pinion 26 and the bevel gear 27, and is transmitted to the output shaft 21.

[0051]The type of the output-device part to combine is changed, and as shown in drawing 6, when the parallel-axis type output-device part S31 is combined, the deceleration rotation on the input shaft 33 acquired from simple epicyclic gear structure is transmitted to the output shaft 31 parallel to the input shaft 33 via the helical gears 36 and 38.

[0052]Thus, the speed change mechanism part H11 of one of types and the power slowed down by H21, Direct transmission of the in-line type S1 case is carried out as it is to the output shaft 11, in an orthogonal-axis type S2 case, it is transmitted to the output shaft 21 via the bevel gear pinion 26 and the bevel gear 27, and, in a parallel-axis type S3 case, an output-device part is transmitted to the output shaft 31 via the helical gears 36 and 38. The direct axis type S2 and parallel-axis type S2 moderating ratio is identically set up for the reason mentioned above.

[0053]Although drawing 2 - drawing 6 show the example of the combination of a GIYADO motor, naturally there may also be the other combination. For example, may combine the in-line type output-device part S11 of drawing 2, and the simple epicyclic gear structure type speed change mechanism part H21 of drawing 4, and. The output-device part S21 the orthogonal-axis type of drawing 4 and drawing 6 or parallel-axis type and the rocking inner gearing planetary gear structure type speed change mechanism part H11 of S31 and drawing 2 may be combined. In [ any ] a type, this The inlaw part 19a of the flanges 19, 29, and 39 or the internal gears 67 and 77, It becomes possible by having unified the formation mode of the pin 100 which unifies the size of 29a, 39a, 67a, and 77a into A, and unifies the pitch diameter of a mounting bolt into B, and functions as an inner pin or hold pins.

[0054]Also about the input-device part N, since pitch-diameter B of the size C of an inlaw part with the speed change mechanism part H and the mounting bolt is unified, change of the same recombination is possible.

[0055]Therefore, according to the attachment mode of a mate machine, can choose the type of an output-device part from the in-line type S1, the orthogonal-axis type S2, and the parallel-axis type S3, and. According to a request of a mate machine and a user, the type of a speed change mechanism part and the type of an input-device part can be chosen, as a result the GIYADO motor of various change gear ratios or motor form can be provided, stopping part mark to the minimum.

[0056]The kind of an output-device part, a speed change mechanism part, and input-device part can also be added if needed.

[0057]

[Effect of the Invention]As explained above, according to this invention, after lessening the kind of parts of series as much as possible, a design suitable for a mate machine can be made easily. Since an orthogonal-axis type and parallel-axis type other than an in-line type were especially put in the choice group of an output-device part, it can respond to the attachment mode of a mate machine flexibly, and can respond also to the request of hollow-shaft-izing. Since the rocking inscribed

engaging-tooth vehicle structure type and the simple epicyclic gear structure type are put in the choice group of a speed change mechanism part, the change gear ratio of  $1/3 - 1/100$  within the limits can also fully be covered.

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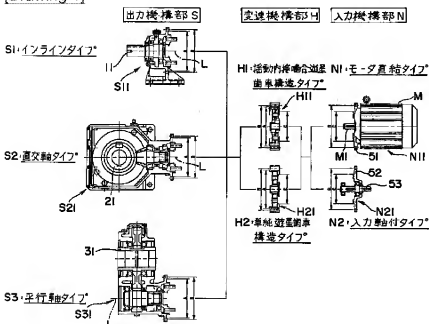
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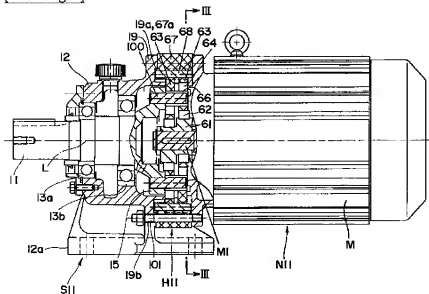
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## DRAWINGS

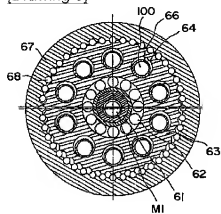
[Drawing 1]



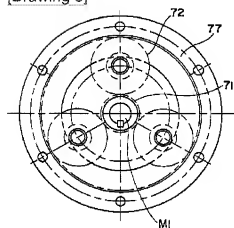
[Drawing 2]



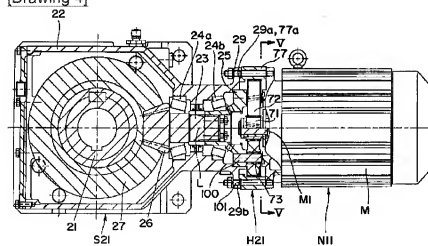
[Drawing 3]



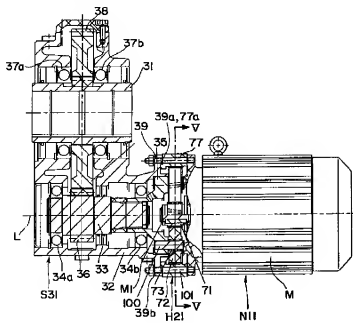
[Drawing 5]



[Drawing 4]



[Drawing 6]



[Translation done.]